CONNECTED VEHICLE PILOT
Deployment Program

Tampa (THEA) Pilot Update at the System Design Milestone

Kate Hartman, Steve Novosad, Dave Miller, Dave McNamara

ITS Joint Program Office
Purpose of this Webinar
- The conceptual overviews and status reports of the Tampa (THEA) pilot project, as well as the technical challenges and lessons learned of the system design process.

Webinar Content
- Connected Vehicle Pilot Deployment Program Overview
- Tampa (THEA) Pilot Overview
- System Design Overview
- Challenges and Lessons Learned
- Stakeholder Q&A

Webinar Protocol
- Please mute your phone during the entire webinar
- You are welcome to ask questions via chatbox at the Q&A Section
- The webinar recording and the presentation material will be posted on the CV Pilots website
- Participate in **Design/Build/Test Phase** Webinars/Conference Presentations from the three Pilot Sites (see website for exact dates and times)

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- Public Webinars
- Conference Presentations

- Visit Program Website for Updates: [http://www.its.dot.gov/pilots](http://www.its.dot.gov/pilots)
- Contact: Kate Hartman, Program Manager, Kate.Hartman@dot.gov
Tampa (THEA) CV Pilot Deployment Concept

Steve Novosad
THEA Pilot overview

Source: HNTB

Pilot Location

- Tampa Florida metropolitan area
- THEA
  - Owns / operates Selmon Expressway
  - Owns Meridian Ave traffic signals
- West: Residential community of Brandon
- East: MacDill Air Force Base
- Study area
  - Midway of Selmon Expressway
  - Shown in red box
THEA Pilot overview

- 41 Roadside Units (RSUs)
- 1600 equipped passenger vehicles
- 10 equipped streetcars / trolleys
- 10 equipped transit buses
- 500 Personal Safety Devices
- 12 V2V, V2I and V2P applications
- Roadside Detection Equipment
  - Unequipped Pedestrian study data
  - Unequipped Vehicle study data
- RSU Management System
- Agency data collection

Source: HNTB
System Design Overview

Dave Miller & Dave McNamara
Work Breakdown progress

P1 Comprehensive Deployment Plan, 3.5.1.1.2

- QG5: LTP5, OIL, Requirements + Cost + Schedule Update, Validate CM
- QG4: LTP4, OIL, Requirements + Cost + Schedule Update, System CM
- QG3: LTP3, OIL, Requirements + Cost + Schedule Update, Subsystem CM
- QG2: LTP2, OIL, Requirements + Cost + Schedule Update, Device/Unit CM
- QG1: LTP1, Distribution Licenses, MTP, Requirements Update per CCB

April 20, 2017
P1 Comprehensive Deployment Plan, 3.5.1.1.2

- **QG5**: LTP5, OIL, Requirements + Cost + Schedule Update, Validate CM
- **QG4**: LTP4, OIL, Requirements + Cost + Schedule Update, System CM
- **QG3**: LTP3, OIL, Requirements + Cost + Schedule Update, Subsystem CM
- **QG2**: LTP2, OIL, Requirements + Cost + Schedule Update, Device/Unit CM
- **QG1**: LTP1, Distribution Licenses, MTP, Requirements Update per CCB
System / subsystem components

- Backend Servers
  - TSP Connect
  - PDETM
  - RSU Monitoring
  - Data Archive

- RSU
  - ERDW
  - I-SIG / TSP
  - Data Collector
  - WWE
  - Ped-X
  - RSU Management

- OBU
  - ERDW
  - TSP
  - WWE
  - PCW
  - VTRFTV
  - FCW / EEBL / IMA
  - OBU Management

- Smartphone (PID)
  - Ped-X
  - Ped-Sig
  - PTMW

- Traffic Signal Controller
- Vehicle & Pedestrian Detectors
TMC Data log archive architecture

Diagram showing the architecture of the TMC data log archive system, including components such as NextConnect (Master Server), RSU Adapter, PII Removal, SQL Reporter, DataBuffer, Data Converter, Data Collector, and related data flows for Queue Length, FCW, EEEL, WME, Bus Arrival on Green, Priority Request History.
Morning Backup

Forward Collision Warning (FCW)
Emergency Electronic Brake Light (EEBL)
End of Ramp Deceleration Warning (ERDW)
Intelligent Signal Systems (I-SIG)

PHOTO: TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)
Functional Flow
Functional Flow
ERDW

Conceptual Design

Detailed Design
ERDW functional

Light Vehicle A OBU
ERDW app receives speed advices and adjusts for vehicle type

TIM
Speed Advice Message

RSU 1
ERDW determines the speed advice for each zone and broadcasts

Lan queue length Message

RSU 2
I-SIG determines length of REL Exit queue

Traditional Vehicle Detector

Infrastructure Sensor Message

SPEED ADVICE MESSAGE

18
Wrong-Way Drivers

Wrong-way Entry
Intersection Movement Assist (IMA)
MAP
Signal Phasing and Timing (SPaT)

PHOTO: TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)
Conceptual Design

Key:
- Equipped Vehicle
- Unequipped Vehicle

Wrong Way Driver (TIM)
REL Gates
Do Not Enter Alert

Traditional Wrong Way Detector

Detailed Design

U.S. Department of Transportation
Functional Flow

Light Vehicle B
OBU
IMA App Calculates Potential Crash

IMA Message

BSMs

Light Vehicle A
OBU
IMA App Calculates Potential Crash

IMA Message

Direction of Travel
Pedestrian Safety

Pedestrian in a Signalize Crosswalk Warning (Ped-X)

Pedestrian Collision Warning (PCW)
Conceptual Design

Detailed Design
Streetcar Conflicts

Vehicle Turning Right in Front of Transit Vehicle (VTRFTV)

PTMW
Functional Flow

Case Example

Streetcar (Baseline Path 0a to 0b) VS:
1: Vehicle Path 1a to 1b (Warning)
2: Vehicle Path 2a to 2b (Warning)
3: Vehicle Path 3a to 3b (False Positive Test)
Transit Signal Priority

I-SIG
Transit Signal Priority (TSP)

IMA

Pedestrian Transit Movement Warning (PTMW)

PHOTO: TAMPA HILLSBOROUGH EXPRESSWAY AUTHORITY (THEA)
TSP

Functional Flow

Traffic Signal Controller receives green extension, sends green extended

RSU 19 - 32
TSP app receives priority request, sends to Master Server, receives priority granted, sends green extension to signal controller, sends priority granted to Bus

Priority request
Priority Denied
Priority Granted

TMC
Master Server
TSP app receives priority request, determines schedule, if behind sends priority request

Bus A
Makes a priority request
Receives priority

Priority request
Priority Granted/Denied
Priority Timeout

Priority Denied/Timeout Notification
Priority Granted Notification

Bus B
GRANTED
Traffic Progression

Probe Data Enabled Traffic Monitoring (PDETM)
Pedestrian Mobility (PED-SIG)
I-SIG
IMA
Detailed Design
Over-The-Air (OTA) Update

Concept: RSUs on REL

Detailed Design
Challenges and Lessons Learned

Dave Miller & Dave McNamara
Challenges and Lessons Learned

- Program
- Infrastructure
- In-Vehicle
Program

- Manage and Perform Professional Privately Owned Vehicle Installs
- Improved Communication with Other Sites
- Security
- Ensure You are Solving Real World Problems
- Adequate CV Penetration versus Traditional ITS Detection Devices
- Better Knowledge of Apps
  - Open Source
  - Individual Vendors
- Prep Work Required to Successfully Deploy
Standards:
- Design using standards published on Jan 1, 2017. Do not rely on unpublished standards in progress
- If a USA standard does not exist design using international standards
- If no standard exists, refer to USDOT V2I Hub publication

Interoperability:
- Pursuit of interoperability among the pilots
- Identify common requirements that affect interoperability, such as crosswalk, before the design started.

Certification process
- Certification process lagged the design process
- Mitigated by Conformance statement to self-certify missing link

Pedestrian Detection
Multiple tech scans using RFPs (with on the road testing) to identify promising suppliers who can meet system, cost and project timing, critical to scrutinize and select the best suppliers.

Early sourcing of suppliers is key to creating a collaborative environment:
- To understand how system requirements are implemented in the design
- To source suppliers who are willing to participate in developing open specifications
- Who can meet aggressive timing with quality as they have adequate development time. always aspects requiring customization of off the shelf technology/standards

Collaboration around common specifications

Early real-life testing with actual infrastructure in place to verify end-to-end system/application performance (OTA, data management, security, etc.)

Distributed Team Across the Country and in Europe
In-Vehicle

- New development efforts - OTA and security - need to be piloted, i.e. tested early in the program

- Adequate incentives with community/media support engage the driver/consumer community

- Recognizing the need for a complete and experience project team - systems, infrastructure, vehicle systems, performance measurement, etc.
- Please keep your phone muted
- Please use chatbox to ask questions
- Questions will be answered in the order in which they were received
Join us for the Getting Ready for Deployment Series

- Discover more about the CV Pilot Sites
- Learn the Essential Steps to CV Deployment
- Engage in Technical Discussion

Visit the Pilot Site Websites for more Information:

- NYCDOT Pilot: https://www.cvp.nyc/
- Tampa (THEA): https://www.tampacvpilot.com/
- Wyoming DOT: https://wydotcvp.wyoroad.info/

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